

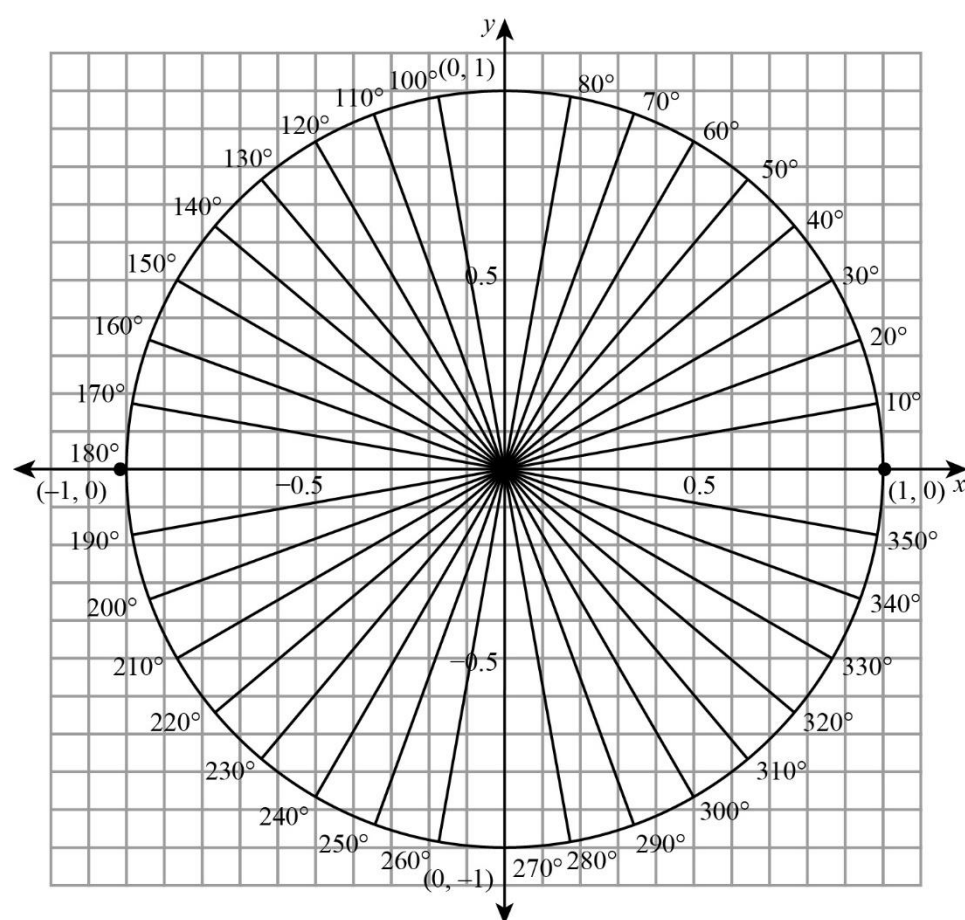
### 3 Geometry and trigonometry

#### Activity: Unit circle (Teacher version)

Below is an image of the full unit circle.

Complete the table and identify the patterns that develop in your results. Write down the patterns that you discover.

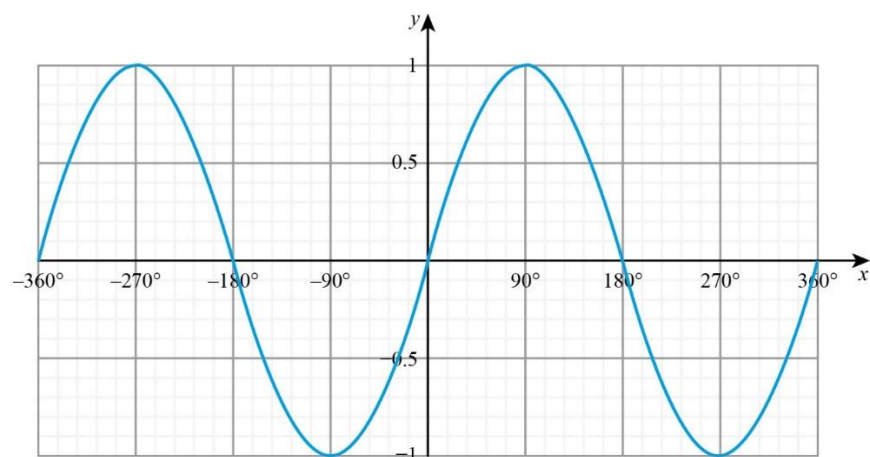
The  $x$ -coordinate is the value of  $\cos \theta$ . The  $y$ -coordinate is the value of  $\sin \theta$ .



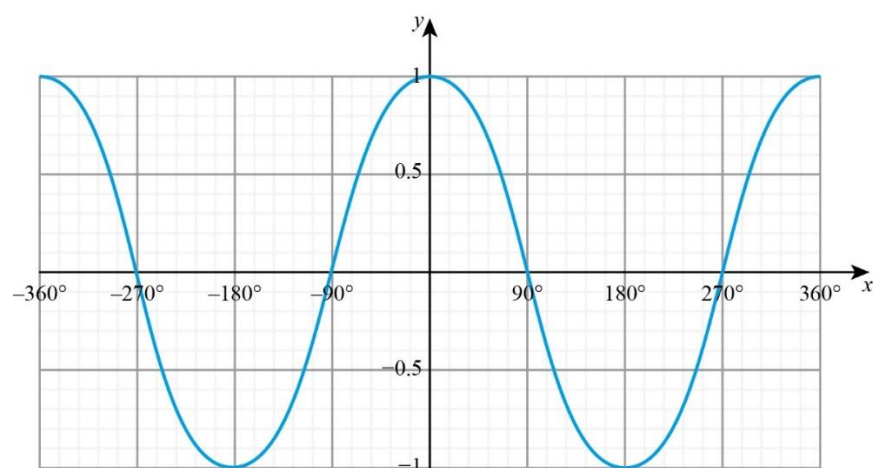
$\theta$ (degrees)	$x$ -coordinate	$y$ -coordinate	$\cos \theta$ (GDC)	$\sin \theta$ (GDC)	$\frac{\sin \theta}{\cos \theta} = \tan \theta$
0	1	0	1	0	0
30	0.866	0.5	0.866	0.5	0.577
45	0.707	0.707	0.707	0.707	1
60	0.5	0.866	0.5	0.866	1.732
90	0	1	0	1	$\infty$
120	-0.5	0.866	-0.5	0.866	-1.732
135	-0.707	0.707	-0.707	0.707	-1
150	-0.866	0.5	-0.866	0.5	-0.577
180	1	0	1	0	0
210	-0.866	-0.5	-0.866	-0.5	0.577
225	-0.707	-0.707	-0.707	-0.707	1
240	-0.5	-0.866	-0.5	-0.866	1.732
270	0	-1	0	-1	$\infty$
300	0.5	-0.866	0.5	-0.866	-1.732
315	0.707	-0.707	0.707	-0.707	-1
330	0.866	-0.5	0.866	-0.5	-0.577
360	1	0	1	0	0
390	0.866	0.5	0.866	0.5	0.577

Use the table and the unit circle to plot the following functions on the axes below. AFTER you have done this, use your GDC to check your answers.

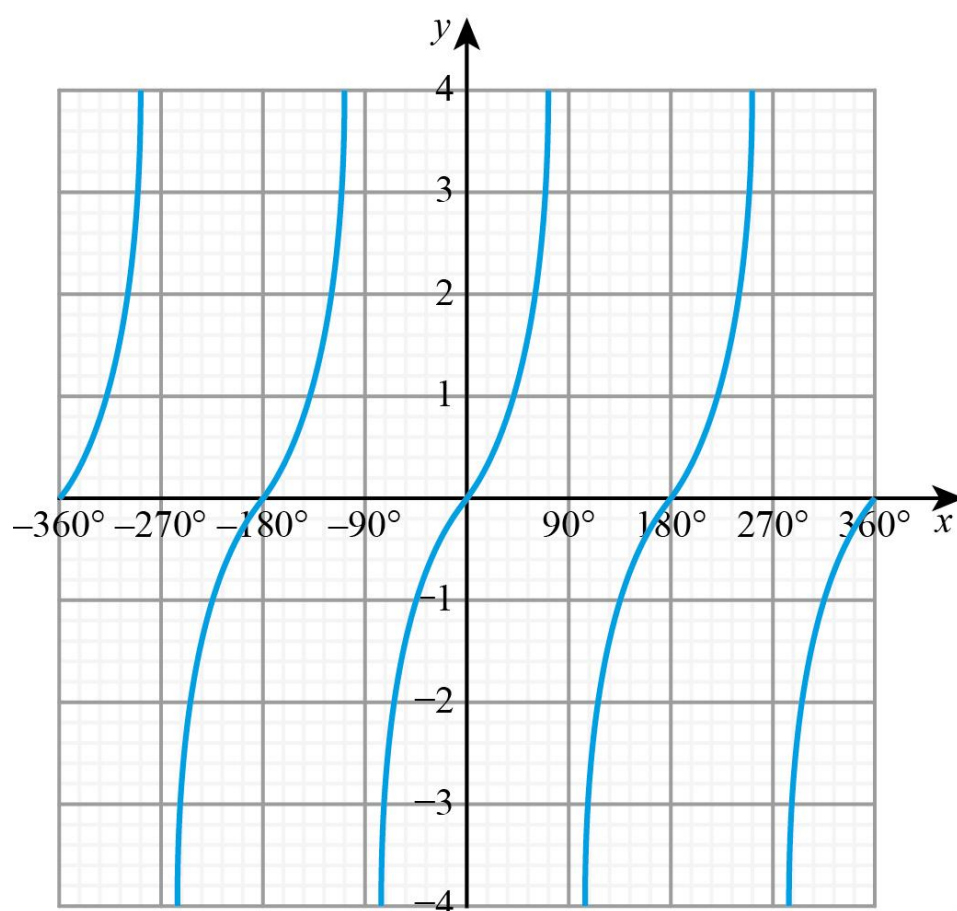
1  $f(\theta) = \sin \theta$  or  $y = \sin x$



2  $f(\theta) = \cos \theta$  or  $y = \cos x$

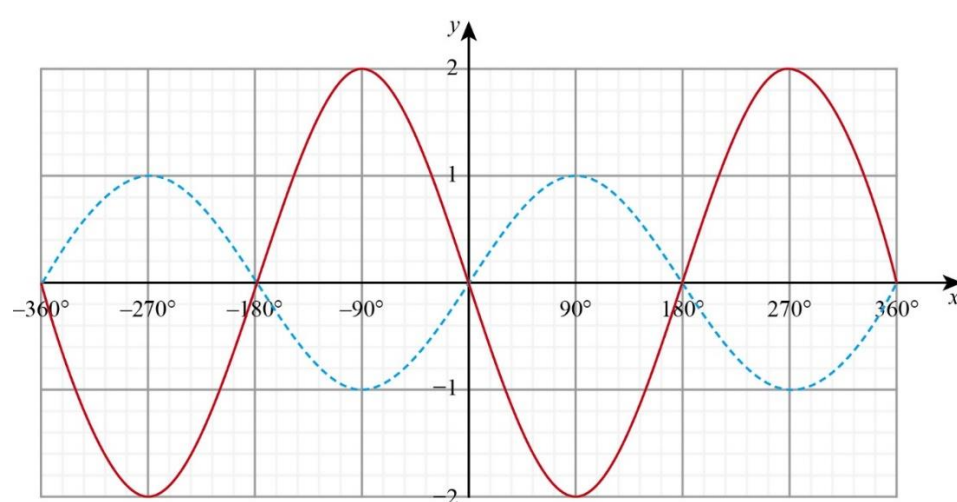


3  $f(\theta) = \tan \theta$  or  $y = \tan x$



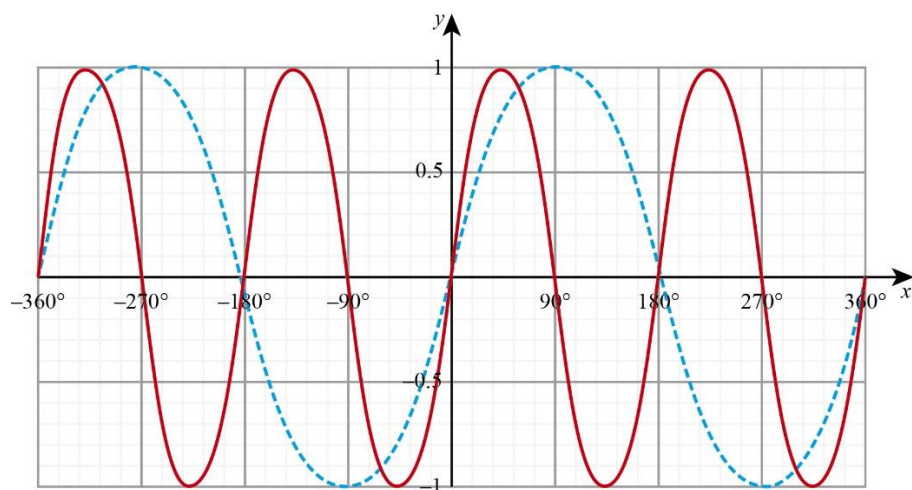
Using your knowledge of transformations, describe each transformation and find trigonometric functions for the following graphs in red (the dashed graph is  $y = \sin x$ ).

4



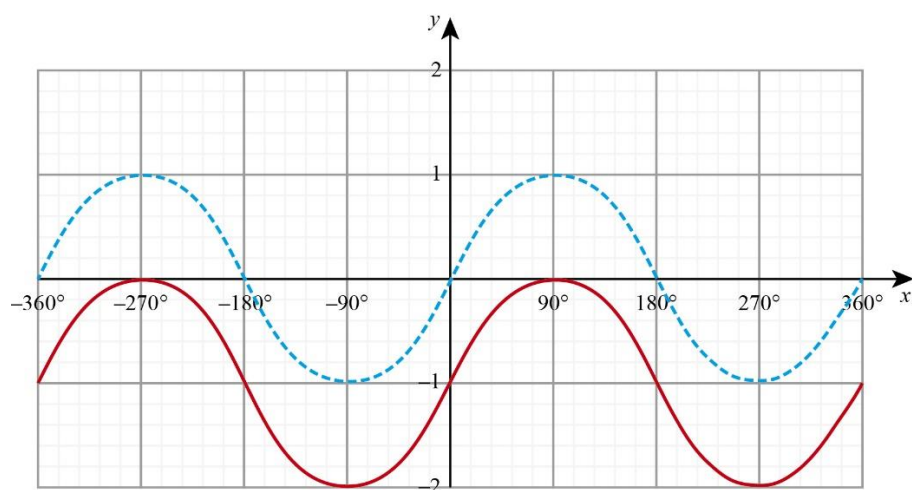
$$y = -2\sin x$$

5



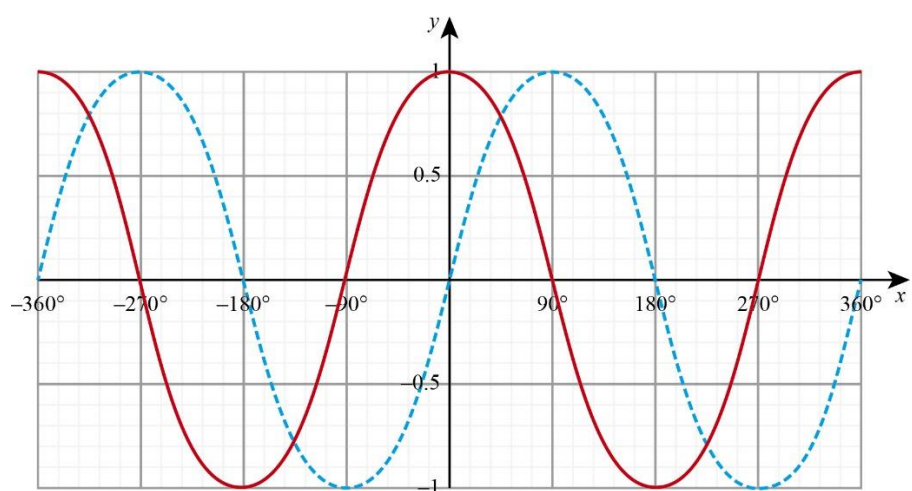
$$y = \sin 2x$$

6



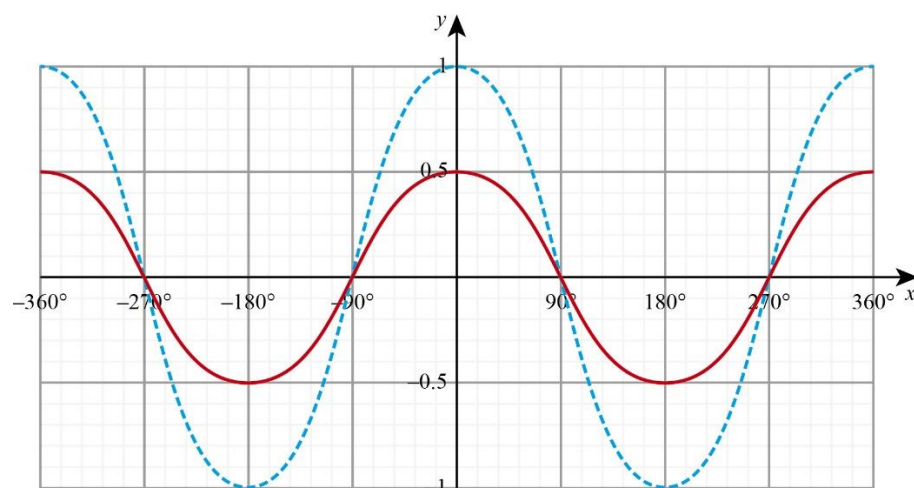
$$y = \sin x - 1$$

7



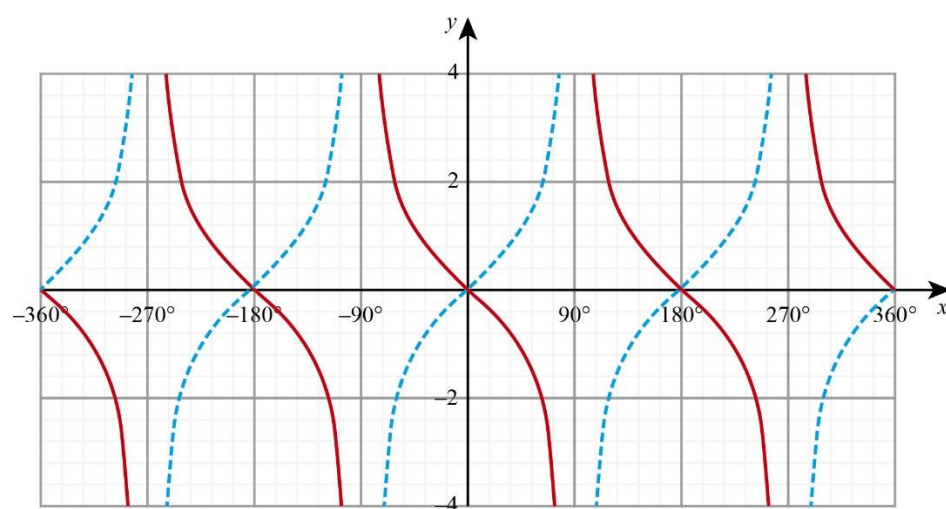
$$y = \sin(x - 90^\circ)$$

8 NOTE: the dashed blue graph is  $y = \cos x$ .



$$y = \frac{1}{2} \cos x$$

9 NOTE: the dashed blue graph is  $y = \tan x$ ; also, write TWO different answers for this question

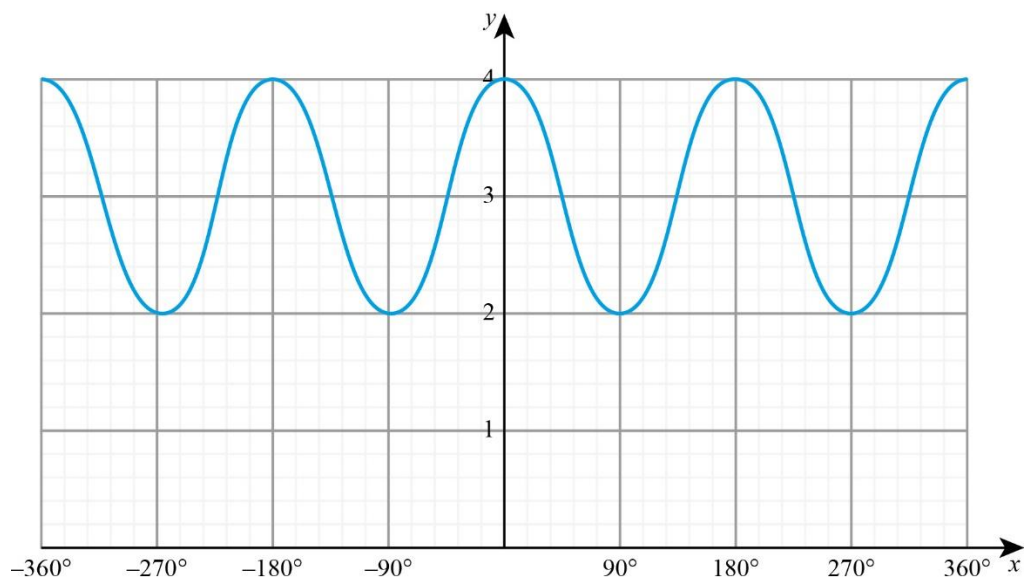


$$y = \tan(-x); y = -\tan x$$

For each of the functions below:

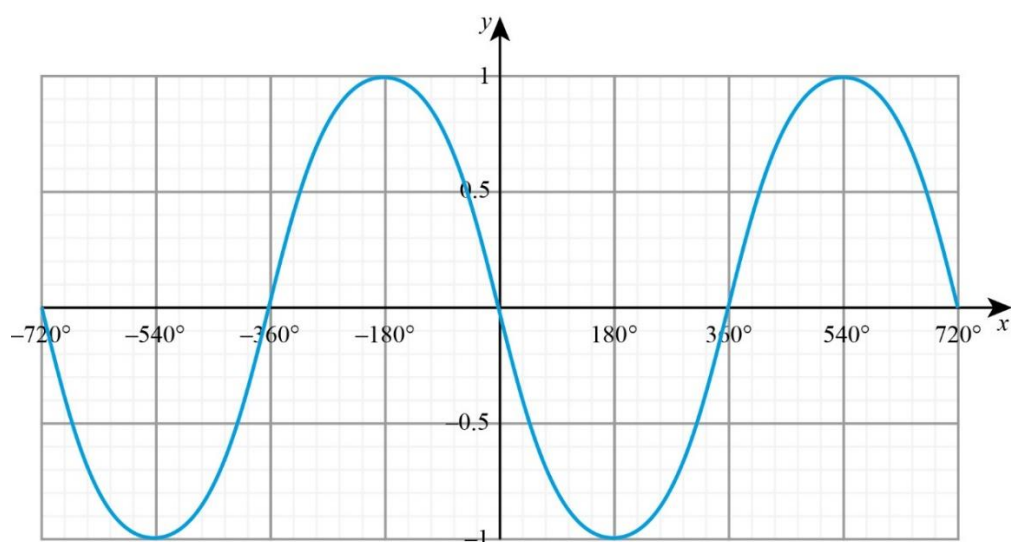
- Briefly describe the transformations.
- Create a trigonometric function for the graph.
- Describe the range.
- Check your answer on your GDC or graphing software.

10



- The graph has been translated 3 units vertically.
- $y = 3\cos x$
- Range  $\{2 \leq y \leq 4\}$

11

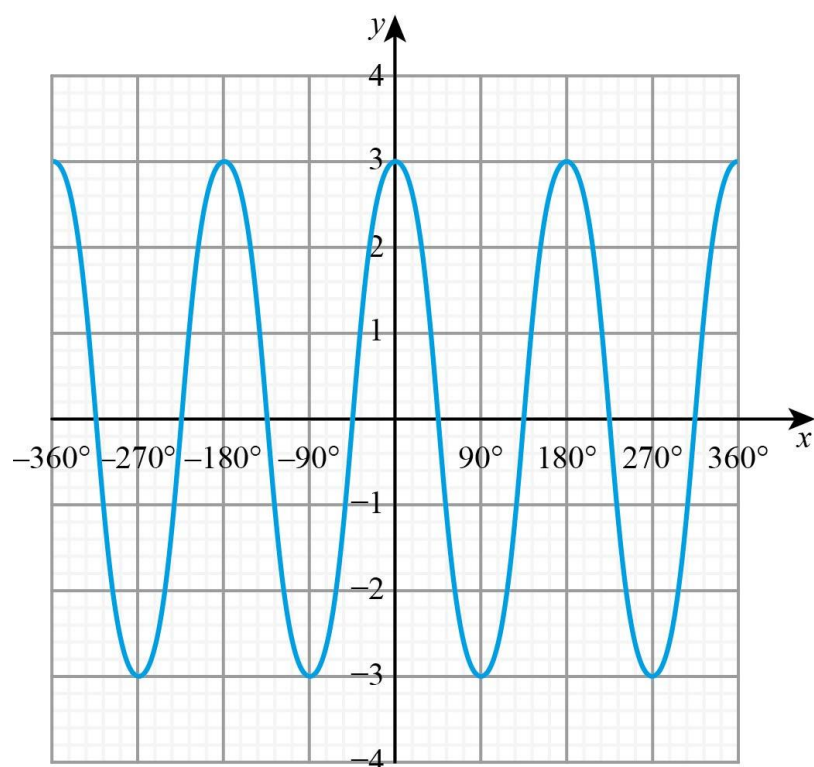


- The graph has been stretched horizontally; its period has changed. It has also been reflected across the  $y$ -axis.
- $y = -\sin \frac{1}{2}x$
- Range  $\{-1 \leq y \leq 1\}$

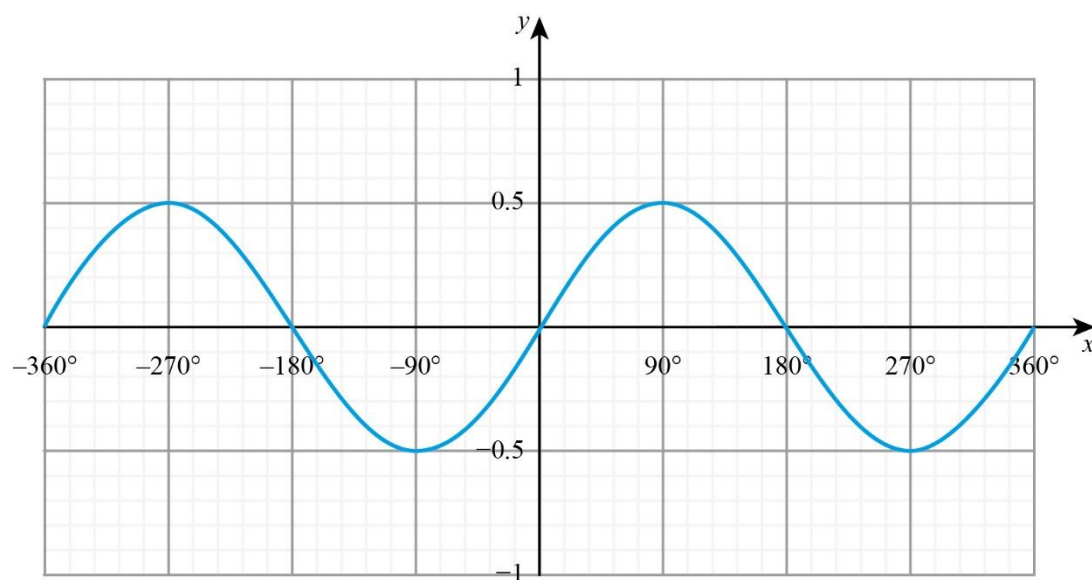


Without using your GDC, graph each of the following functions.

12  $y = 3 \cos 2x$

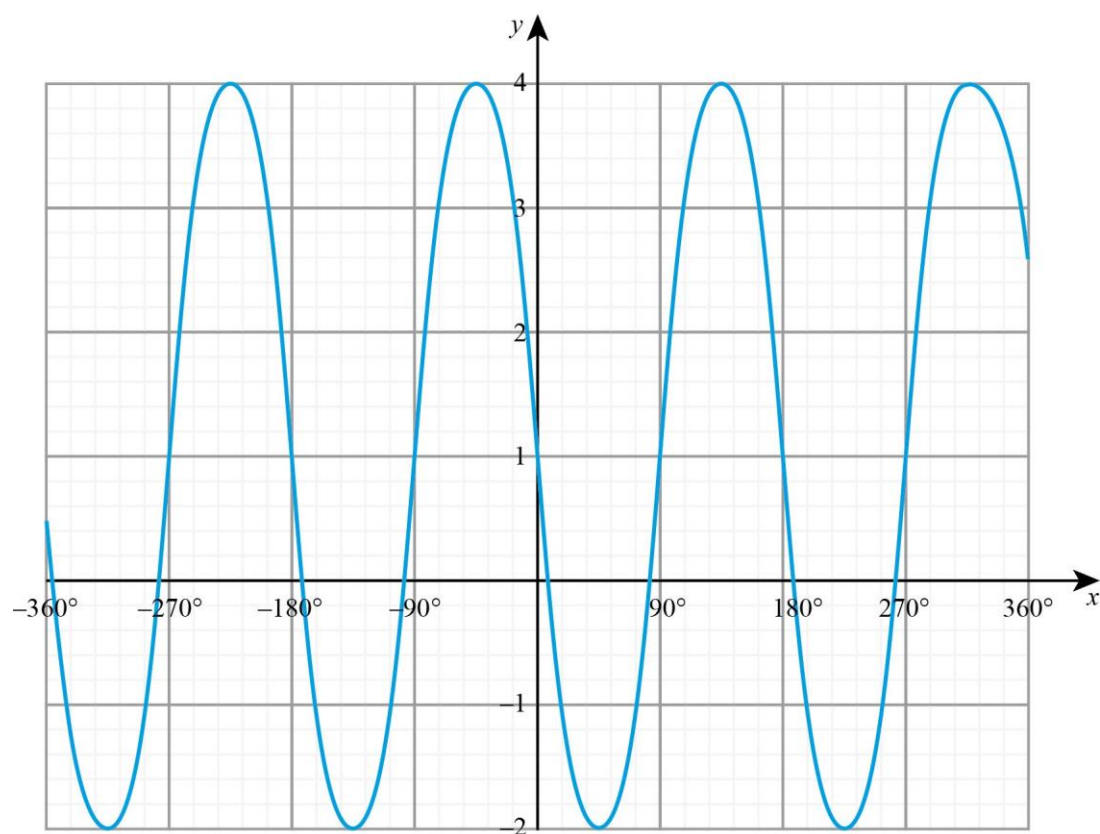


13  $y = -0.5 \sin(x + 180^\circ)$



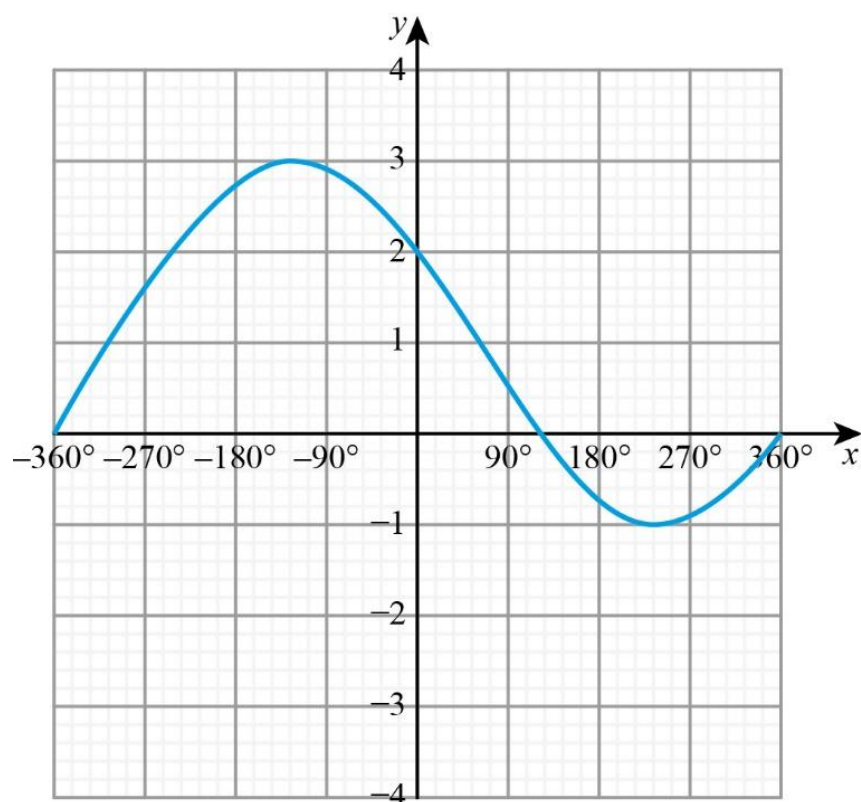


14 Create a function for the graph below.

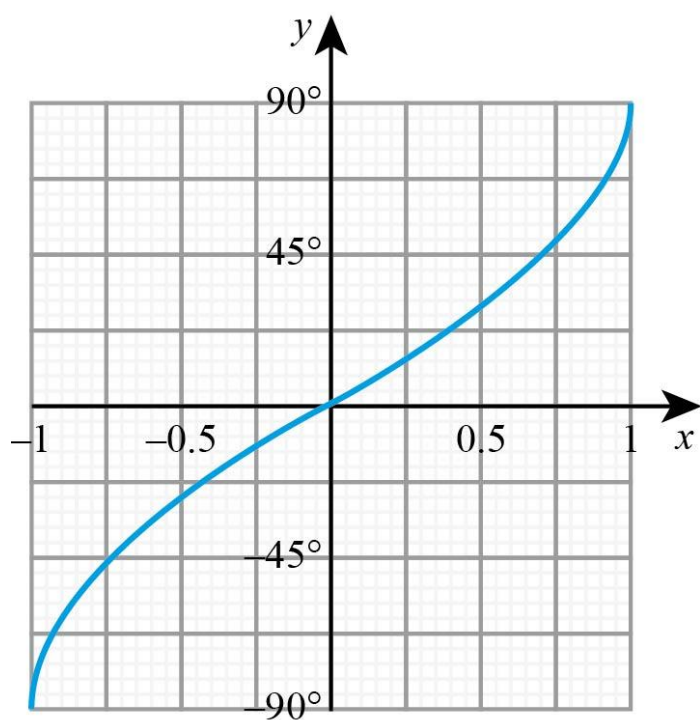


$$y = 3 \cos(2x + 15^\circ) + 1$$

15 Graph  $y = -2\sin x(0.5x - 30^\circ) + 1$



16 Create a function for the graph below. Be sure to describe the range as well.



$$x = \sin y$$

$$\text{Range } \{-1 \leq x \leq 1\}$$